

FISH MANAGEMENT REPORT 142

OCTOBER 1989

Bureau of Fisheries Management • Department of Natural Resources • Madison, Wisconsin 53707

IMPACT OF CONTINUOUS FISHING
ON THE WALLEYE POPULATION OF
LAKE DUBAY, MARATHON COUNTY,
WISCONSIN, 1983-84

By

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ABSTRACT

This study evaluates the impact of a year-round open season on Lake DuBay walleye, Stizostedion vitreum vitreum, and provides a biological profile of that population for comparison with other Wisconsin walleye. Lake DuBay, a 6,653-acre reservoir on the Wisconsin River near Mosinee, has been open to continuous walleye fishing since lake formation in 1942. From April 1983 through April 1984, researchers gathered data on population levels, age and growth, and recruitment for Lake DuBay walleye. This included monitoring tag returns from 988 jaw-tagged walleye, which provided information on exploitation, time and location of harvest, and migration. In 1983, Lake DuBay had an estimated minimum population of 2.1 walleye/acre that were ≥ 11.0 inches long. Harvest during the study was concentrated at 4 locations, with 68.8% of tag returns from walleye harvested below the Big Eau Pleine dam. March, April, and part of May accounted for 71.0% of tag returns, whereas this period was closed to walleye fishing on other waters. Estimated minimum exploitation was 18.8%, and total mortality for walleye aged 5-7 years was about 36.9%. Study results did not indicate overharvest. However, should overharvest occur, I recommend a closed season on Lake DuBay or a fish refuge below the Big Eau Pleine dam for conserving this walleye population.

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INTRODUCTION

The walleye, Stizostedion vitreum vitreum, is Wisconsin's most popular gamefish. It populates 1,312 lakes and 231 streams statewide. About 663,000 anglers harvested approximately 1,706,000 walleye in Wisconsin during the mid-1970s (Anonymous 1979).

The 1979 Wisconsin Fish Management Strategic Plan called for surveying the state's walleye fisheries and evaluating management impact on those fisheries. Therefore, this study of Lake DuBay proposed to:

- Survey walleye movement, standing stock, length frequency, growth and age, mortality, and exploitation.

- Evaluate the impact of a specially regulated, continuously open season.

STUDY AREA

Lake DuBay is a 6,653-acre hydroelectric reservoir on the Wisconsin River approximately 25 miles south of Wausau (Fig. 1). Among its 12 feeder streams, the Wisconsin, Big Eau Pleine, and Little Eau Pleine rivers are the major inlets. Its outlet is the Wisconsin River.

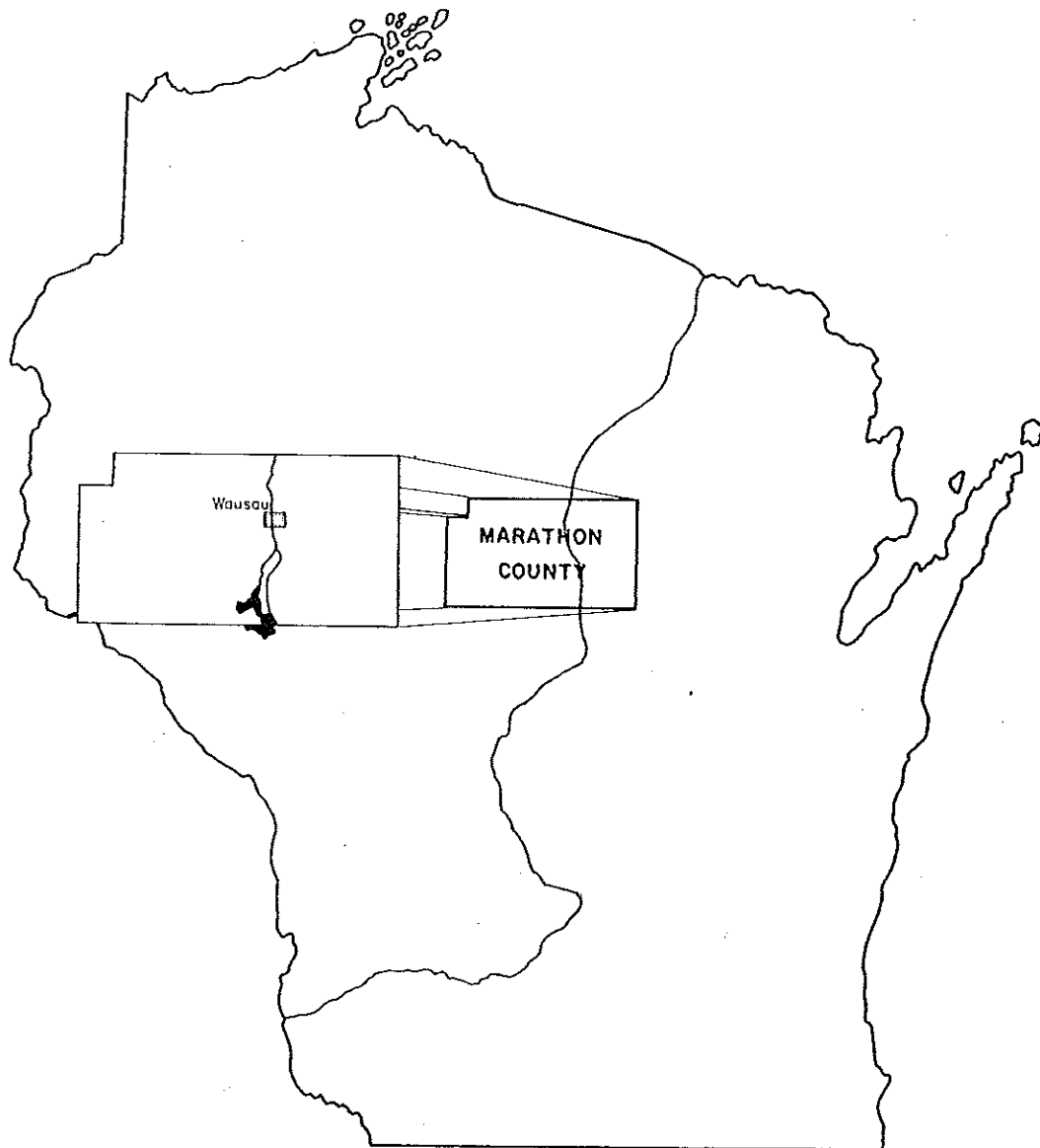
Extensive shoreline development along the lower two-thirds of Lake DuBay includes 122 dwellings, two campgrounds, two county parks, and a town park. Public access to the lower one-third of the reservoir is fair but otherwise, poor.

Lake DuBay water is soft (MPA 33 ppm), circumneutral (pH 6.8), and medium brown in color. Its maximum depth is 30 feet. Littoral bottom materials are primarily sand, gravel, rubble, and muck. Overall aquatic vegetation is of low density, but moderate to heavy algae blooms during midsummer. There are some stump-filled flats in the upper one-third of the flowage.

Since its creation in 1942, Lake DuBay has suffered water quality problems from industrial and municipal discharges. Fish from the lake have periodically had a "sulphury" odor and taste, elevated mercury levels, and other contamination. Recently, however, improved water quality has increased public interest in the fishery.

Lake DuBay has no closed fishing season, no minimum size limit, and a daily bag limit of 5 gamefish -- except for muskellunge, trout, and sturgeon. Of these, only muskellunge are known to be present, and the open season for them corresponds with standard muskellunge-fishing regulations.

Figure 1. Location of Lake DuBay in Marathon County.

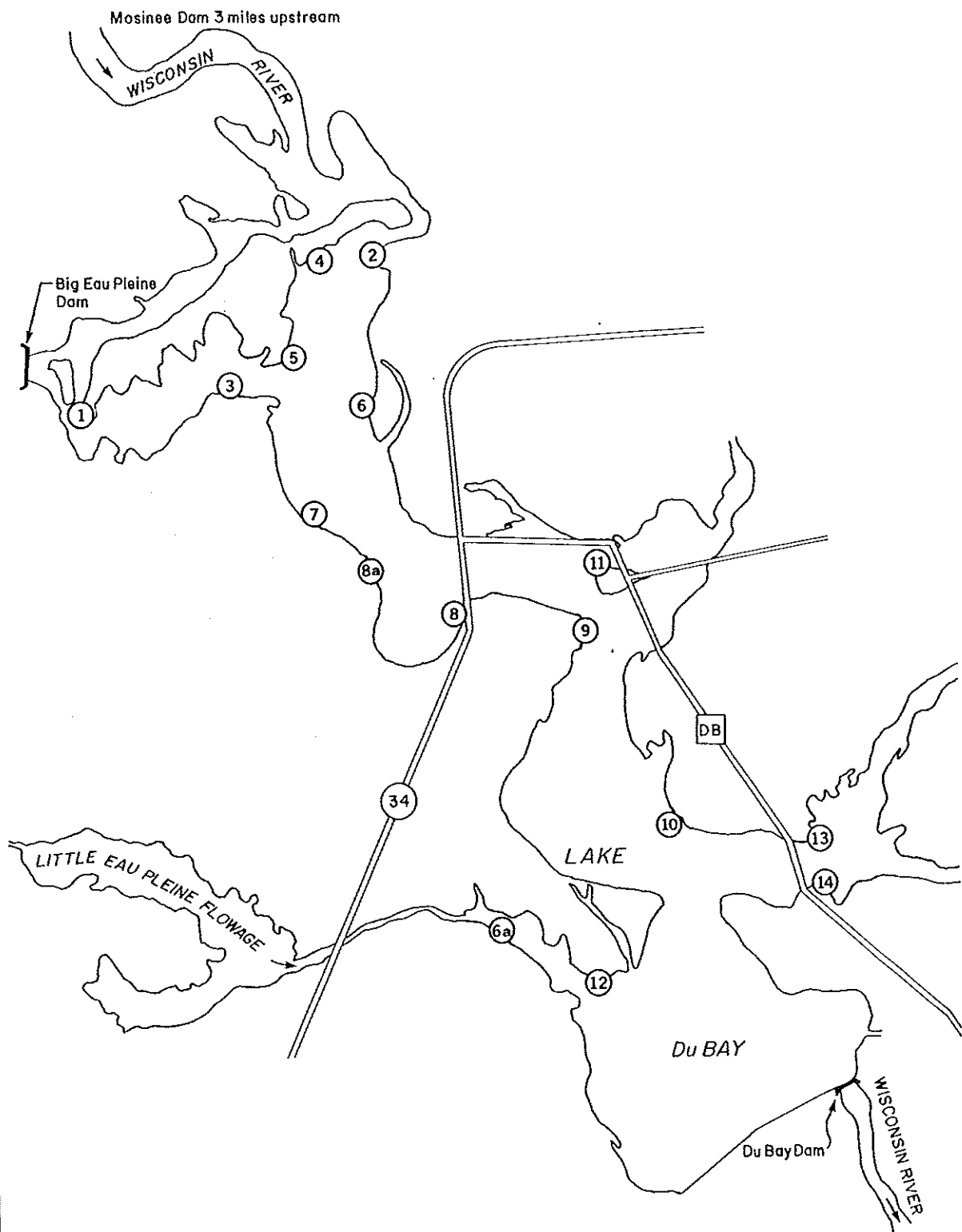


METHODS

Ice-out was earlier than usual on Lake DuBay in 1983 (8-15 April), followed by prolonged cool temperatures.

Between 30 March and 27 April, 4- and 5-ft fyke nets with 1-inch² mesh were dispersed throughout the reservoir in likely walleye-spawning areas (Fig. 2). Altogether, researchers made 180 fyke net lifts during that time. They also electrofished for 2.5 hours on the evening of 28 April.

Figure 2. Locations of 1983 fyke net samplings.



Records of all sampled walleye included length to the nearest 0.1 inch. When possible, researchers gathered 10 scale samples from each length group ≥ 11.0 inches for aging. They then estimated the number of walleye per age group by apportioning the number per length group ≥ 11.0 inches according to the age subsample (Table 1).

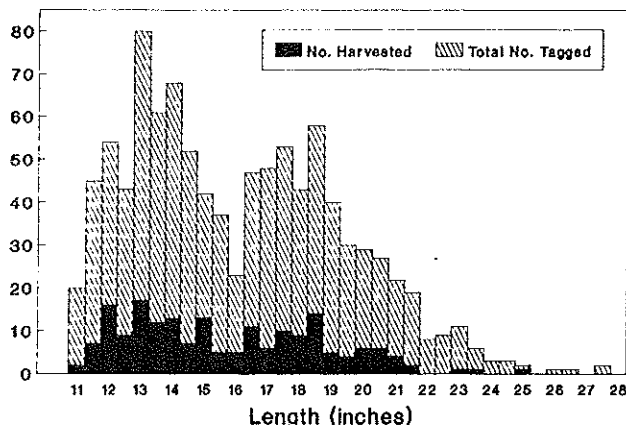
Table 1. Average walleye length by age group.

Age (years)	Average Length (inches)	No. of Fish
1	8.1	15
2	10.1	10
3	12.5	38
4	15.3	16
5	17.3	21
6	18.6	12
7	20.6	11
8	21.9	8
9	23.5	1

Because of the difficulty in scale-aging older walleye and because female walleye don't mature until age 4-5, only age groups 5-7 were used for developing the catch curve (Ricker 1975). Also, when it was possible to extrude eggs or milt, researchers differentiated the sexes.

All captured gamefish received a temporary top caudal clip or a numbered monel jaw tag. Researchers marked 988 walleye that were ≥ 11.0 inches with the jaw tags (Fig. 3).

Figure 3. Length distribution (by 0.5-inch increments) of tagged (988) and harvested (186) walleye.



Walleye population estimates, using both Bailey's Modification of the Petersen formula (Ricker 1975) and the Darroch/Schnabel Model (Youngs and Robson 1978), were based on recapture data from spring fyke-netting and electrofishing (Table 2).

Table 2. Spring 1983 adult walleye population estimates.

Date	Method	Population	95% CL
4-20-83	Bailey's Modification	15,294	1,995-28,593
4-22-83	Bailey's Modification	17,687	6,202-29,172
4-24-83	Bailey's Modification	13,493	7,699-19,287
4-25-83	Bailey's Modification	13,404	8,404-18,404
4-26-83	Bailey's Modification	7,075	3,939-10,211
4-27-83	Bailey's Modification	23,906	11,540-36,272
4-28-83	Bailey's Modification	13,829	8,570-19,088
4-28-83	Darroch/Schnabel Model	14,041	11,809-16,273

A cooperative outreach program encouraged anglers to return tags from harvested walleye. The Lake DuBay Lions Club, for example, posted signs at all public accesses, printed and distributed other public notices, contacted local businesses, arranged for tag pick-ups, and assisted with field data collection.

John Nechuta, dam tender at the Big Eau Pleine dam, collected tags from anglers fishing that dam's access-controlled tailwaters at the head of Lake DuBay. The Wisconsin Valley Improvement Company, which owns the dam and surrounding property, allows access to the tailwaters only when the dam tender is present.

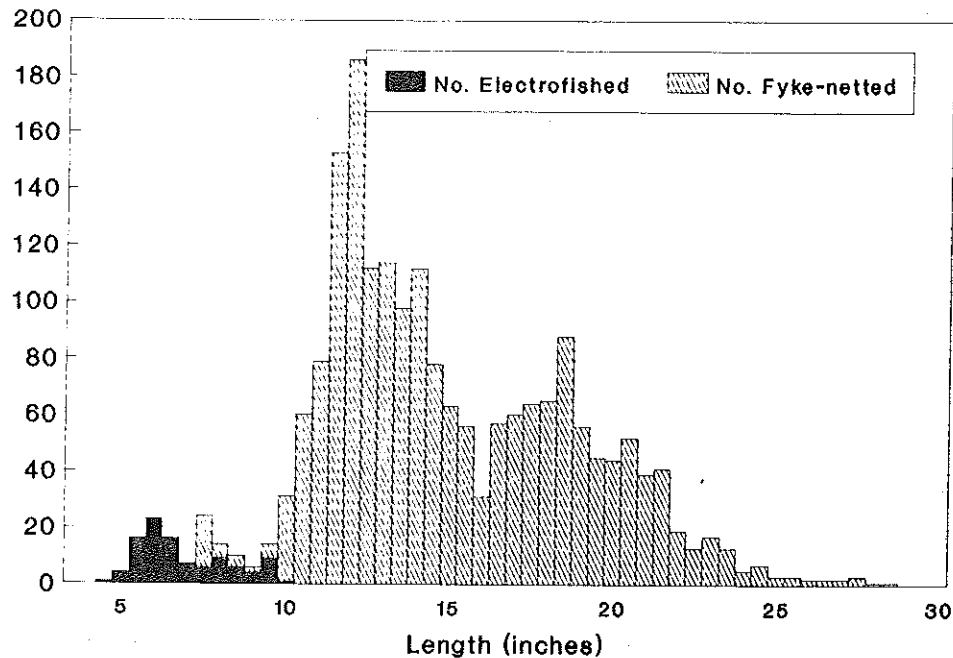
The "tagging" story was also published in all newspapers within 30 miles of Lake DuBay and featured on other local media.

RESULTS AND DISCUSSION

SAMPLE SIZE AND COMPOSITION

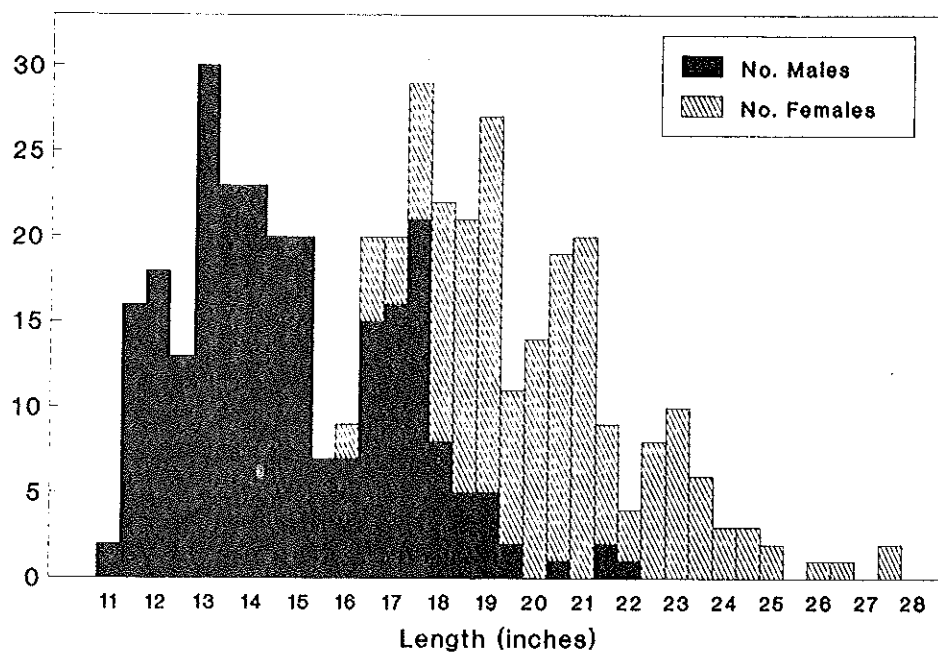
The total study sample was 2,241 walleye: 1,957 netted, ranging 7.0-29.9 inches long, and 284 electrofished, ranging 4.9-10.4 inches long (Fig. 4).

Figure 4. Length distribution of sampled walleye (by 0.5-inch increments).



Netted male walleye were 11.2-22.1 inches long; female walleye, 16.5-27.9 inches long (Fig. 5). The ratio of sex-differentiated walleye was 1.37 male to 1.00 female.

Figure 5. Length distribution of male and female walleye (by 0.5-inch increments)



Length distribution of Lake DuBay walleye did not indicate overharvest. It was similar to walleye length distribution data from the Flambeau Flowage (Table 3), a large reservoir with a traditional fishing season (season open from first Saturday in May through 1 March, daily bag limit of 5 walleye, no size limit) and light fishing pressure of 15.7 hours/acre (Lealos and Bever 1982). Lake DuBay actually had a higher percentage of 17.0-inch walleye than the Flambeau Flowage or Butternut, Pike, and Round lakes. Large walleye, ≥ 20 inches, comprised 12.1% of the Lake DuBay sample compared to only 0.2-2.3% for the other waters.

Table 3. A comparison of walleye length distributions from springtime samplings.

Length (inches)	Flambeau Flowage ^a 14,300 acres, 1975		Butternut Lake ^b 1,006 acres, 1973		Pike and Round lakes ^c 1,500 acres, 1972		Lake DuBay 6,653 acres, 1983	
	No.	%	No.	%	No.	%	No.	%
≤ 11.0	3,071	22.6	1,155	39.0	1,624	43.9	454	20.3
11.0-12.9	2,468	18.2	1,066	36.0	956	25.8	531	23.7
13.0-14.9	3,623	26.7	415	14.0	880	23.8	402	17.9
15.0-16.9	2,637	19.4	207	7.0	188	5.8	209	9.3
17.0-19.9	1,451	10.7	56	1.9	43	1.2	380	17.0
20.0-24.9	285	2.1	41	1.4	9	0.2	253	11.3
≥ 25.0	25	0.2	21	0.7	1	0.03	17	0.8
Totals	13,560		2,961		3,702		2,241	

^aLealos and Bever 1982

^bBever and Lealos 1977

^cBever and Lealos 1974

Lake DuBay length distribution data did indicate less abundance in the 15.0- to 17.5-inch range, perhaps due to poor production or a sampling bias. Fyke nets in spawning areas predominantly sample mature fish. Female walleye in Lake DuBay mature at about 16.5 inches. Therefore, immature female walleye in the 15.0- to 17.5-inch range may have been inadequately sampled.

POPULATION ESTIMATES

With Bailey's Modification, the Petersen estimate was 13,829 walleye ≥ 11.0 inches. The Darroch/Schnabel estimate was 14,041 walleye ≥ 11.0 inches, and with a 95% confidence interval the range was 11,809-16,273. Thus, during spring 1983, the Lake DuBay population of walleye ≥ 11.0 inches was approximately 2.1 fish/acre.

The population density of walleye ≥ 11.0 inches was lower in Lake DuBay than the 5.9-6.9 fish/acre densities found in the Flambeau Flowage and Butternut, Pike and Round lakes (Bever and Lealos 1974 and 1977, Lealos and Bever 1982). Population estimates during the spawning period tend to be accurate for the spawning population only and biased toward the male sector. Therefore, the actual density of walleye ≥ 11.0 inches in Lake DuBay was likely higher and approximates the lower end of ranges found in the northwest Wisconsin lakes.

AGE AND GROWTH

Lake DuBay walleye did not show the accelerated growth rates or early maturation that characterize over-exploitation (Spangler et al. 1977).

Male walleye first mature at age 3 and at about 12.6 inches; female walleye, at age 4 and at about 16.5 inches. Age 3 male and age 4 female walleye were observed spawning in Lake DuBay. The smallest sex-differentiated male walleye sampled during the survey was 11.2 inches; the smallest female, 16.5 inches.

Lake DuBay walleye growth rates until age 7 were similar to walleye growth rates in other Wisconsin reservoirs (Table 4). At ages 8-9, Lake DuBay walleye were at least 2 inches longer than their counterparts from the other reservoirs.

Table 4. A comparison of walleye growth rates in selected Wisconsin reservoirs.

Age	Average Total Length (inches)				
	Lake DuBay (1983)	Lake Alice (1982) ^a	Jersey City Flowage (1981) ^b	Lake Mohawksin (1980) ^c	Flambeau Flowage (1975) ^d
1	8.1	--	7.6	5.2	5.7
2	10.1	10.8	9.8	8.8	9.0
3	12.5	14.6	12.0	13.1	10.8
4	15.3	16.3	14.2	16.2	12.6
5	17.3	17.7	16.1	17.3	14.3
6	18.6	18.5	17.0	18.5	15.8
7	20.6	19.7	18.8	19.7	17.0
8	21.9	--	19.8	--	18.3
9	23.5	--	--	--	19.3

^aHauber 1983

^bHauber 1982

^cHauber 1981

^dBever and Lealos 1982

These growth differences were not likely related to water quality or fertility, which varied little among the reservoirs (Table 5). However, the apparent growth differences at ages 8-9 may be related to the difficulty of scale-aging older walleye.

Table 5. A comparison of physical and chemical characteristics in selected Wisconsin reservoirs.

Reservoir	Surface Area (acres)	Maximum Depth (feet)	pH	MPA ¹ (ppm)	River System
Lake DuBay	6,653	30	6.8	33	Wisconsin
Lake Alice	1,369	32	6.7	52	Wisconsin
Jersey City Flowage	433	20	6.8	39	Tomahawk
Lake Mohawksin	1,910	25	7.2	32	Wisconsin
Flambeau Flowage	14,300	50	7.1	32	Turtle and Flambeau

¹Methyl Purple Alkalinity

EXPLOITATION RATES

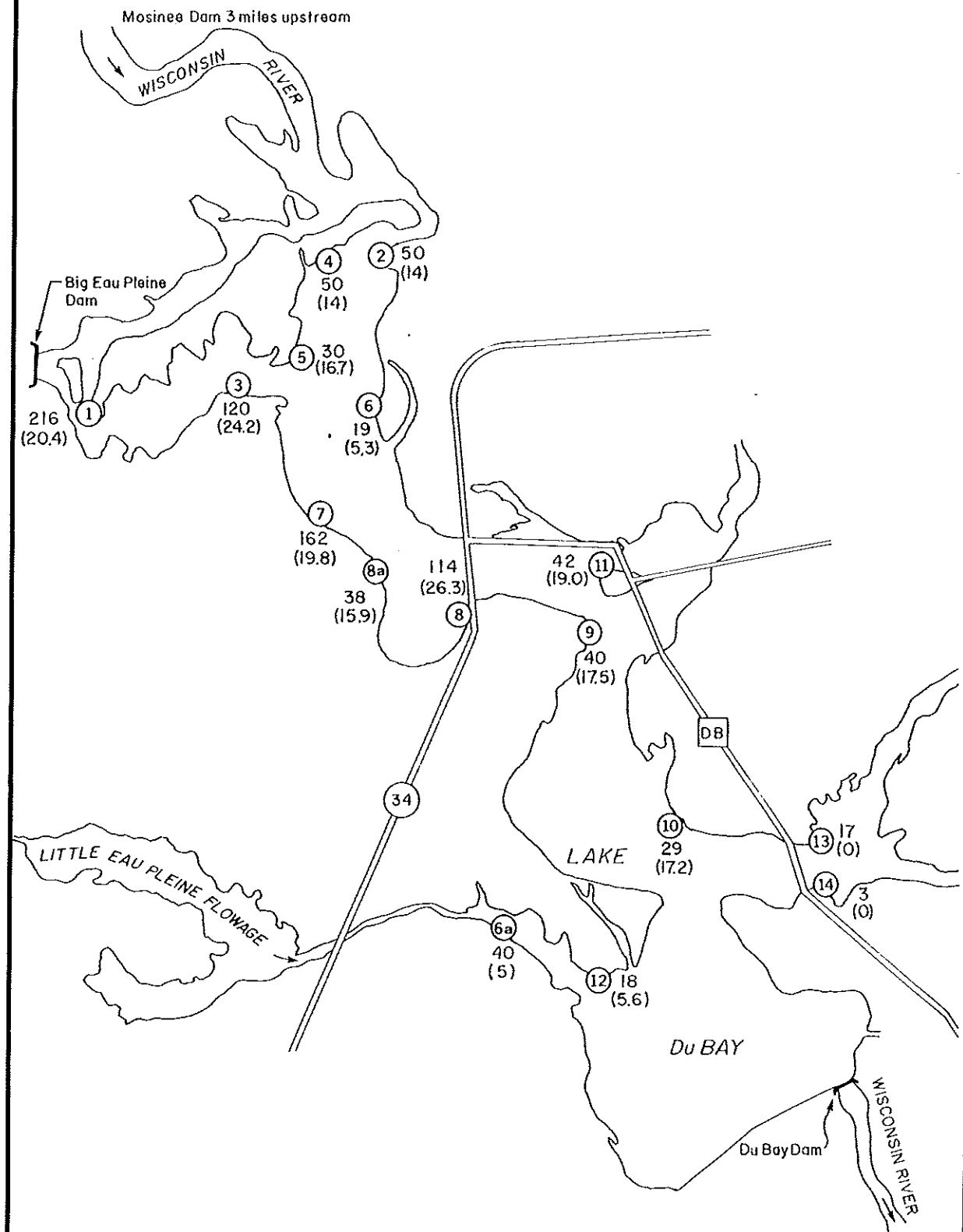
Tag returns from 186 of 988 marked walleye indicated a minimum exploitation rate of 18.8%. Voluntary tag return studies always involve some nonreporting of recaptures that, along with tag loss, results in an underestimating of exploitation.

During this Lake DuBay study, there was essentially a creel check below the Big Eau Pleine dam where anglers had access only when the dam tender, who collected tags, was present. With this area being the known major area of harvest, non-reporting of recaptures was minimized. Adjusting the rate of exploitation for a 25% tag loss increased the exploitation to less than 24%, a level similar to findings in other studies.

Lealos and Bever (1982) reported a 24% exploitation rate for walleye from the Flambeau Flowage. Mraz (1968) had 20.8-22.4% of tags returned during a Pike Lake study, while Priegel (1968) had 21.8% of tags returned during a Wolf River study. Kempinger et al. (1975) reported an average exploitation of 26% on several U.S. walleye lakes.

Minimum exploitation of walleye marked at different Lake DuBay locations was 0-26.3% (Fig. 6). In general, exploitation was highest upstream from State Highway 34.

Figure 6. Number of walleye tagged at each sampling site and percent later harvested (in parentheses).



Smaller walleye, 11.0-14.9 inches, had the highest adjusted exploitation rate at 29.2%, and ≥ 22.0 -inch walleye had the lowest at 8.7% (Table 6). Searns and Kempinger (1981) also found exploitation decreased as size increased, but they found no difference in the exploitation of male vs. female walleye. In Lake DuBay, minimum exploitation of male walleye was 25.1%; of female walleye, 19.4%.

Table 6. Exploitation rates by walleye size.

Length (inches)	No. Fish Marked	No. Fish Harvested	Minimum Rate (%)	Adjusted Rate (%)*
11-11.9	65	15	23.1	29.2
11-14.9	358	84	23.5	29.3
≥ 11	988	186	18.8	23.6
≥ 19	213	25	11.7	14.6
≥ 22	46	3	6.5	8.7

*Assuming 25% tag loss/non-reporting of harvested walleye.

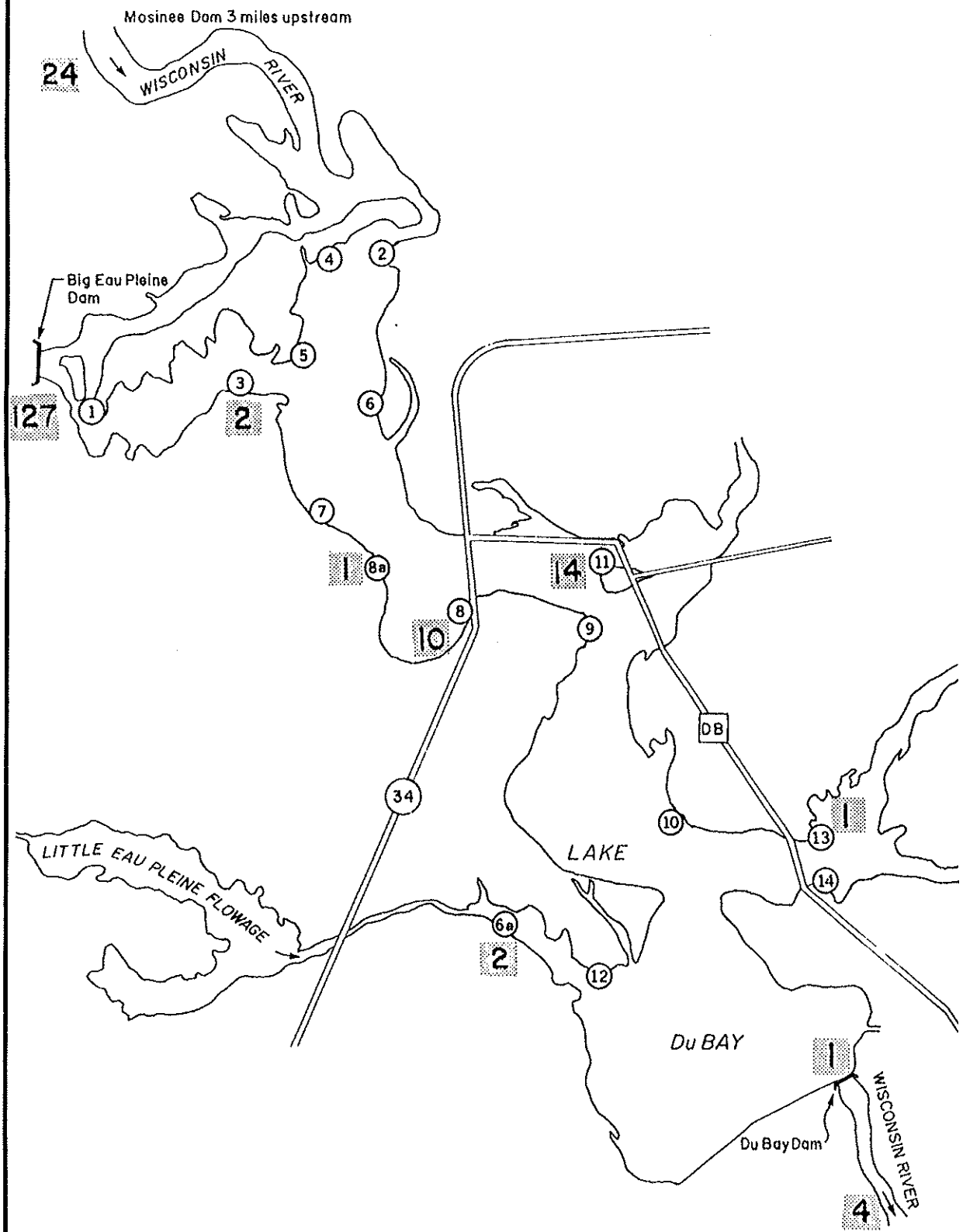
HARVEST TIME AND LOCATION

Tag returns indicated that harvest occurred primarily during March and April and was concentrated at 4 locations. The highest harvest occurred during April 1983 (59.7% of tag returns), while overall the months traditionally closed to fishing (March, April, and early May) accounted for 71% of the harvest (Table 7). The areas of highest harvest were the Big Eau Pleine dam (68.8% of tag returns), the Mosinee dam, the State Highway 34 bridge, and the Village of Knowlton, respectively (Fig. 7).

Table 7. Monthly harvest of tagged walleye.

Month	Year	No. Harvested	% of Total Harvest
Apr	1983	111	59.7
May 1-5	1983	6	3.2
May 6-31	1983	26	14.0
Jun	1983	12	6.5
Jul	1983	4	2.2
Aug	1983	0	0
Sep	1983	5	2.7
Oct	1983	4	2.2
Nov-Dec	1983	0	0
Jan	1984	3	1.6
Feb	1984	0	0
Mar	1984	2	1.1
Apr 1-21	1984	13	7.0

Figure 7. Number of tagged walleye harvested and locations where they were caught.



Daily counts of walleye harvested below the Big Eau Pleine dam were made by the dam tender, John Nechuta (Table 8). He reported 3,775 walleye harvested in April 1983 and 4,434 in April 1984, although tag returns significantly declined during April 1984. From 1 January through 24 April 1983, Nechuta counted 10,602 harvested walleye; from 1 January through 25 April 1984, 10,180.

Table 8. Walleye harvest¹ from the Big Eau Pleine dam tailwaters.

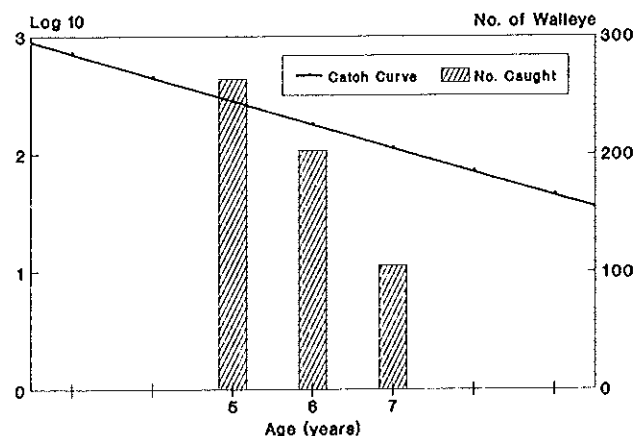
Month	1983 Harvest		1984 Harvest	
	No.	%	No.	%
Jan	945	8.9	780	7.7
Feb	1,643	15.5	2,163	21.2
Mar	4,239	40.0	2,803	27.5
Apr	3,775	35.6	4,434	43.6
Total	10,602		10,180	

¹Nechuta, unpublished data -- for all-sized walleye

MORTALITY RATES

Fishing and natural mortality for ≥ 5 -year-old walleye were estimated to be 17.5% and 19.4%, respectively. Total mortality as estimated from the catch curve for walleye aged 5-7 was 36.9% (Fig. 8).

Figure 8. 1983 walleye catch curve.



The mortality rate for Lake DuBay walleye was comparatively low. Lealos and Bever reported mortality for ≥ 3 -year-old walleye in the Flambeau Flowage at 70% (1982) and for walleye ≥ 9 inches in Butternut Lake at 43% (1977). Kempinger and Carline (1977) reported that total mortality in Escanaba Lake was 32-69% with a 47% mean.

MIGRATION PATTERNS AND MOVEMENT

Fyke net catch per unit effort and tag returns indicate that walleye generally move up-reservoir in spring. Most recaptures were below the Big Eau Pleine and Mosinee dams. A lack of recaptures and low catch per unit effort indicate little or no movement into the lower Little Eau Pleine Flowage, the Little Eau Claire River, and Johnson Creek.

Some downstream migration did occur, including movement through the Lake DuBay dam. Anglers harvested 4 tagged walleye in the tailwaters of the Lake DuBay dam. No apparent adverse environmental conditions encouraged the downstream movement.

MANAGEMENT RECOMMENDATIONS

Despite intensive springtime harvests below the Big Eau Pleine dam, the Lake DuBay walleye population had not been overharvested. Although adult abundance was relatively low, natural reproduction, population structure, growth, exploitation, and mortality were all within normal range for walleye populations subject to standard fishing regulations (no continuous season), light to moderate fishing pressure, and light to moderate harvest.

However, should the need arise, I recommend two management alternatives to reduce Lake DuBay walleye harvest:

- Eliminate continuous fishing on Lake DuBay since 71.0% of tag returns were from walleye harvested during the months traditionally closed to fishing.

- Establish a fish refuge below the Big Eau Pleine dam since 68.8% of tag returns were from walleye harvested at that location.

A closed season might be more effective for reducing harvest because the impact of a refuge could be offset by anglers moving to alternate fishing sites on Lake DuBay.

LITERATURE CITED

Anonymous

1979. Comprehensive Fish and Wildlife Plan. Wis. Dept. Nat. Resour.

Bever, G.G. and J.M. Lealos

1974. Walleye Fishery in Pike and Round Lakes, Price County, Fish Manage. Sect. Rep. No. 73. 16 pp.

Bever, G.G. and J.M. Lealos

1977. The walleye in Butternut Lake, Price County, Wisconsin. Wis. Dept. Nat. Resour. Fish Manage. Rep. No. 96. 12 pp.

Hauber, A.B.

1981. Comprehensive survey, Lake Mohawksin, Lincoln County. Wis. Dep. Nat. Resour. Inter-Dep. Memo. 27 pp.

Hauber, A.B.

1982. Comprehensive survey, Jersey City Flowage, Lincoln County. Wis. Dep. Nat. Resour. Inter-Dep. Memo. 26 pp.

Hauber, A.B.

1983. Comprehensive survey, Lake Alice, Lincoln County. Wis. Dep. Nat. Resour. Inter-Dep. Memo. 21 pp.

Kempinger, J.J. and R.F. Carline

1977. Dynamics of the walleye (Stizostedion vitreum vitreum) population in Escanaba Lake, Wisconsin, 1955-72. J. Fish Res. Board of Can. 34(10):1800-1811.

Kempinger, J.J., W.S. Churchill, G.R. Priegel and L.M. Christenson

1975. Estimates of abundance, harvest, and exploitation of the fish population of Escanaba Lake, Wisconsin, 1946-69. Wis. Dep. Nat. Resour. Tech. Bull. 84. 30 pp.

Lealos, J.M. and Bever, G.G.

1982. The Flambeau Flowage Fishery. Wis. Dept. Nat. Resour.
Fish Manage. Rep. No. 110. 17 pp.

Mraz, D.

1968. Recruitment, growth, exploitation and management of
walleyes in a southeastern Wisconsin lake. Wis. Dept.
Nat. Resour. Tech. Bull. 40. 38 pp.

Priegel, G.R.

1968. The movement, rate of exploitation and homing behavior
of walleye in Lake Winnebago and connecting waters,
Wisconsin, as determined by tagging. Trans. Wis. Acad.
Sci. Arts. Letters 56:207-223.

Ricker, W.E.

1975. Computation and interpretation of biological statistics
of fish populations. Bull. Fish. Resour. Bd. Can.
No. 191. 383 pp. Ottawa.

Serns, S.L. and J.J. Kempinger.

1981. Relationship of angler exploitation to the size, age,
and sex of walleye in Escanaba Lake, Wisconsin. Trans.
Amer. Fish. Soc. 110:216-220.

Spangler, G.R., N.R. Payne, J.E. Thorpe, J.M. Byrne,
H.A. Reigier, and W. J. Christie.

1977. Response of percids to exploitation. J. Fish. Resour.
Bd. Can. 34(10):1983-1988.

Youngs and Robson.

1978. IBP Handbook #3.

ACKNOWLEDGEMENTS

Larry Smith, Ron Theis, Larry Vander Kelen, Rick Halder, and members of the Lake DuBay Lions Club assisted with the study.

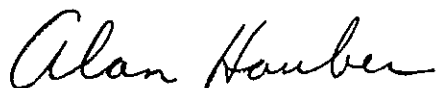
Max Johnson and Steve Searns critically reviewed the manuscript.

Special thanks to John Nechuta for his special effort collecting tag returns and Lois Bernhardt for her assistance and typing.

Also, thanks to Michael Hansen for technical review and to Kendra Nelson for editing.

ABOUT THE AUTHOR

I have been a WDNR Fisheries Manager in the Antigo Area since 1973. I have an MS-Fisheries Biology from South Dakota State University. I have a long-term interest in large reservoir management, especially the impact of liberal regulations.



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